

what is claimed is:

1. A microporous polyolefin membrane, composed of (A) a polyolefin having a weight-average molecular weight of  $5 \times 10^5$  or more or (B) a composition containing this polyolefin, wherein average pore size gradually decreases from at least one membrane surface towards its center.
2. The microporous polyolefin membrane according to Claim 1, wherein each of the through-holes in said microporous polyolefin membrane has a large opening and a smaller size at the center.
3. The microporous polyolefin membrane according to Claim 1, wherein each of the through-holes in said microporous polyolefin membrane has a large opening and tapers off towards the opposite side.
4. The microporous polyolefin membrane according to one of Claims 1 to 3, wherein the average pore size (a) in the area from the surface to a depth of  $d/16$  (d: thickness of said membrane) is 0.05 to  $50\mu\text{m}$ , and the average pore size (b) in the other area is 0.01 to  $30\mu\text{m}$ , where the relationship  $(b) < (a)$  should hold.
5. The microporous polyolefin membrane according to one of Claims 1 to 4, wherein said polyolefin (A) has a weight-average molecular weight of  $1 \times 10^6$  to  $15 \times 10^6$ .
6. The microporous polyolefin membrane according to one of Claims 1 to 4, wherein said polyolefin composition (B) is composed of an ultra-high-molecular-weight polyolefin having a weight-average molecular weight of  $1 \times 10^6$  to  $15 \times 10^6$  and a polyolefin having a weight-average molecular weight of  $1 \times 10^5$  or more but less than  $1 \times 10^6$ .

7. The microporous polyolefin membrane according to one of Claims 1 to 6, wherein said polyolefin composition (B) contains an ultra-high-molecular-weight polyolefin having a weight-average molecular weight of  $7 \times 10^5$  or more at 1 weight % or more.
8. The microporous polyolefin membrane according to one of Claims 1 to 4 or Claims 6 to 7 wherein said polyolefin (A) or polyolefin composition (B) has a weight-average molecular weight/number-average molecular weight ratio ( $M_w/M_n$ ) of 300 or less.
9. The microporous polyolefin membrane according to one of Claims 1 to 4 or Claims 6 to 8 wherein said polyolefin (A) or polyolefin composition (B) has a weight-average molecular weight/number-average molecular weight ratio ( $M_w/M_n$ ) of 5 to 50.
10. The microporous polyolefin membrane according to one of Claims 1 to 4 or Claims 6 to 9, wherein said polyolefin composition (B) is composed of an ultra-high-molecular-weight polyolefin having a weight-average molecular weight of  $5 \times 10^5$  or more, high-density polyethylene and polymer for giving a shut-down property, said polymer for giving a shut-down function being selected from the group consisting of low-density polyethylene, polyethylene having a weight-average molecular weight of 1,000 to 4,000 and melting point of 80 to 130°C, and ethylene-based copolymer having a melting point of 95 to 125°C and produced in the presence of a single-site catalyst.
11. The method of producing a microporous polyolefin membrane according to one of Claims 1 to 10, wherein said polyolefin (A) or polyolefin for said composition (B) is polypropylene or polyethylene.

12. A method of producing a microporous polyolefin membrane, comprising the steps of extruding the solution, composed of 10 to 50 weight % of (A) a polyolefin having a weight-average molecular weight of  $5 \times 10^5$  or more or (B) a composition containing this polyolefin and 50 to 90 weight % of a solvent, into a gel-like formed article and removing the solvent therefrom, wherein a treatment step with a hot solvent is incorporated.
13. The method of producing a microporous polyolefin membrane according to Claim 12, wherein said treatment step with a hot solvent is effected at from the crystal dispersion temperature to melting point plus  $10^\circ\text{C}$  of said (A) polyolefin or (B) polyolefin composition.
14. The method of producing a microporous polyolefin membrane according to Claim 12 or 13, wherein said treatment step with a hot solvent is effected prior to said step of removing the solvent.
15. The method of producing a microporous polyolefin membrane according to Claim 12 or 13, wherein said treatment step with a hot solvent is effected subsequent to said step of removing the solvent.
16. The method of producing a microporous polyolefin membrane according to Claim 12 to 15, wherein said polyolefin (A) has a weight-average molecular weight of  $1 \times 10^6$  to  $15 \times 10^6$ .
17. The method of producing a microporous polyolefin membrane according to Claim 12 to 15, wherein said polyolefin composition (B) is composed of an ultra-high-molecular-weight polyolefin having a weight-average molecular weight of  $1 \times 10^6$  to  $15 \times 10^6$  and a polyolefin having a weight-average molecular weight of  $1 \times 10^5$  or more but less than  $1 \times 10^6$ .

18. The method of producing a microporous polyolefin membrane according to one of Claims 12 to 15 or Claim 17, wherein said polyolefin composition (B) contains an ultra-high-molecular-weight polyolefin having a weight-average molecular weight of  $7 \times 10^5$  or more at 1 weight % or more.
19. The method of producing a microporous polyolefin membrane according to one of Claims 12 to 18, wherein said polyolefin (A) or polyolefin composition (B) has a weight-average molecular weight/number-average molecular weight ratio ( $M_w/M_n$ ) of 300 or less.
20. The method of producing a microporous polyolefin membrane according to one of Claims 12 to 18, wherein said polyolefin (A) or polyolefin composition (B) has a weight-average molecular weight/number-average molecular weight ratio ( $M_w/M_n$ ) of 5 to 50.
21. The method of producing a microporous polyolefin membrane according to one of Claims 12 to 19, wherein said polyolefin (A) or polyolefin for said composition (B) is polypropylene or polyethylene.
22. The method of producing a microporous polyolefin membrane according to one of Claims 12 to 21, wherein the average pore size (a) in the area from the surface to a depth of  $d/16$  (d: thickness of said membrane) is 0.05 to 50 $\mu\text{m}$ , preferably 1 to 30 $\mu\text{m}$ , and the average pore size (b) in the other area is 0.01 to 30 $\mu\text{m}$ , preferably 0.03 to 2 $\mu\text{m}$ , where the relationship  $(b) < (a)$  should hold.
23. The method of producing a microporous polyolefin membrane according to one of Claims 12 to 15 or Claim 17, wherein said polyolefin composition (B) is composed of a polyolefin having a weight-average

molecular weight of  $5 \times 10^5$  or more and polyolefin having a weight-average molecular weight of 1,000 to 4,000 and melting point of 80 to 130°C.

24. The method of producing a microporous polyolefin membrane according to one of Claims 12 to 15 or Claims 17 to 22, wherein said polyolefin composition (B) is composed of (B-1) an ultra-high-molecular-weight polyolefin having a weight-average molecular weight of  $5 \times 10^5$  or more and (B-2) a polyolefin having a weight-average molecular weight of less than  $5 \times 10^5$ , the (B-2)/(B-1) weight ratio being 0.2 to 20
25. The method of producing a microporous polyolefin membrane according to one of Claims 12 to 15 or Claims 17 to 22, wherein said polyolefin composition (B) is composed of a polyolefin having a weight-average molecular weight of  $5 \times 10^5$  or more and polypropylene having a weight-average molecular weight of  $3 \times 10^5$  or more.
26. The method of producing a microporous polyolefin membrane according to one of Claims 12 to 15 or Claims 17 to 22, wherein said polyolefin composition (B) is composed of a polyolefin having a weight-average molecular weight of  $5 \times 10^5$  or more and ethylene-based copolymer having a melting point of 95 to 125°C and produced in the presence of a single-site catalyst.
27. The method of producing a microporous polyolefin membrane according to one of Claims 12 to 15 or Claims 17 to 22, wherein said polyolefin composition (B) is composed of 1 to 69 weight % of an ultra-high-molecular-weight polyolefin having a weight-average molecular weight of  $7 \times 10^5$  or more, 98 to 1 weight % of a high-density polyethylene, and 1 to 30 weight % of a low-density polyethylene.

28. The method of producing a microporous polyolefin membrane according to one of Claims 12 to 27, wherein stretching said gel-like article is an essential step.

29. The method of producing a microporous polyolefin membrane according to Claim 28, wherein said stretching step is effected at an areal ratio of 15 to 400.

30. A battery separator which uses the microporous polyolefin membrane according to Claim 1.

31. A battery which uses the microporous polyolefin membrane according to Claim 1 for its separator.

32. A filter which uses the microporous polyolefin membrane according to Claim 1.